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## ABSTRACT

# Software Architecture for a Highly Autonomous Spacecraft Control System

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Future space missions will continue to be scientifically and technically more ambitious, and will demand more autonomy to accomplish complex tasks in uncertain environments and in close proximity to extraterrestrial bodies. in addition to mission demands, affordability is now a primary drive.r. The call is for smaller missions with greatly reduced cost of operation. Spacecraft with highly-autonomous, goal -directed control systems would be required to meet these challenges. It is believed that the autonomy in addition to reducing the mission operations cost, will enable science objectives not possible using the current spacecraft architectural designs.

Currently, autonomy in the spacecraft ACS is limited to attitude control and estimation, command interpretation and maneuver execution. All other functions are decomposed into sequences of low level commands on the ground and loaded onto the spacecraft computer for execution using the on-board command interpreter. These deliberative functions require; ground based observation, estimation and planning. In addition, current ACS architectures cannot support event-driven, real-time or near real-time. reactive systems, which forms the core of any highly autonomous control systc.in.

This paper describes a software architecture for highly autonomous attitude and articulation control subsystem. The concept is applied to a proof-of-concept attitude and control subsystem (ACS) with ability to capture science events and enable a small body rendezvous and sample return mission with minimal ground operation support.

The. technology to be developed and demonstrated includes: on-board sequence generation and execution, precision closed-loop maneuver and attitude control, target acquisition and tracking, and sensing and representation of space.craft system state..